



Assessment of Levels of Glycosylated Hemoglobin in Patients with Periodontal Pathologies: A Comparative Study

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ABSTRACT

Introduction: One of the potential sources for the occurrence of various systemic pathologies, such as cardiovascular diseases, cerebrovascular diseases, and respiratory diseases is periodontitis. Testing of glycosylated hemoglobin (HbA) is a highly standardized procedure and is becoming increasingly popular these days due to its cost-effectiveness and ease of use. Literature quotes numerous studies associating the periodontal diseases with various hemoglobin markers in diabetic and nondiabetic patients. Hence, we planned the present study to assess the levels of HbA in patients with periodontitis among nondiabetic patients.

Materials and methods: For the present study, a total of 50 nondiabetic subjects who reported to the department with the chief complaint of periodontitis were included. Another set of 50 nondiabetic individuals were included in the present study of comparable age in whom no periodontitis was detected clinically. Clinical examination and radiographic evaluation was performed for the selection of the cases for the study group. The patients were sent to the laboratory after the clinical examination, for the testing of HbA. Testing of the hemoglobin A1c (HbA1c) levels

of all the subjects and controls was performed and values were noted and evaluated.

Results: Nonsignificant results were obtained while comparing the mean HbA1c concentrations among the study group and the control group. Nonsignificant results were obtained while comparing the mean HbA1c levels among males and females. While comparing the mean HbA1c levels between the study group and the control group divided on the basis of body mass index, nonsignificant results were obtained.

Conclusion: In nondiabetic subjects, no significant correlation could be observed between periodontitis and HbA1c levels.

Clinical significance: The HbA1c cannot be used as a reliable maker for differentiation of patients with periodontal pathologies from patients free of periodontal pathologies.

Keywords: Diabetes, Glycosylated hemoglobin, Periodontitis.

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INTRODUCTION

It has been a long belief that all the individuals of the world have equal susceptibility for the development of periodontal pathologies. Dental plaque, poor oral hygiene, and occlusal trauma, all collectively have been proposed to be the imitative factors for the occurrence of periodontitis. Specific bacterial organism and infections are the causative etiologic factor for the occurrence of periodontal diseases.¹ With the advancement in understanding of the pathogenesis of periodontitis, there is a need for the development of specific markers that will lead to the identification of the susceptible humans at a higher risk for the development of periodontitis so

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that appropriate measures can be taken for doing early treatment planning. During the past decade, there has been an increase in the knowledge of factors that act as possible link between the periodontal pathologies and systemic health.^{2,3}

Through the pathway of a nonenzymatic reaction, glucose binds to the hemoglobin in an irreversible manner leading to the formation of glycosylated hemoglobin (HbA). The major subfraction of HbA is hemoglobin A1c (HbA1c). Since HbA1c is based on the mean life cycle time of red blood cells, glycemic control over the past 4 to 12 weeks is reflected in terms of it.⁴

Literature quotes numerous studies in which higher severity of periodontal diseases is seen in diabetic subjects in comparison to nondiabetic subjects; there is a paucity of studies targeting only the nondiabetic individuals.⁵ Hence, we planned the present study to evaluate the levels of HbA1c in nondiabetic patients with periodontitis.

MATERIALS AND METHODS

The present study was conducted in the Department of Dentistry of the medical institution and included assessment of 50 nondiabetic subjects who reported to the department with the chief complaint of periodontitis from June 2014 to May 2016. These subjects comprised the subject group. Another set of 50 nondiabetic individuals were included in the present study of comparable age in which no periodontitis was detected clinically. The study group included 50 patients with signs and symptoms of periodontitis, while the control group included subjects with no clinical and attachment loss and bleeding on probing. Ethical approval was taken from the Institutional Ethical Committee and written consent was obtained after explaining in detail the entire research protocol. All the patients aged between 35 and 60 years of age. Exclusion criteria for the present study included:

- Patients with history of diabetes
- Patients with history of any other systemic illness
- Patients who underwent any major or minor surgical procedure in the past 1 year
- Patients with history of antibiotic therapy for more than 3 days in the past 6 months
- Patients with habit of smoking

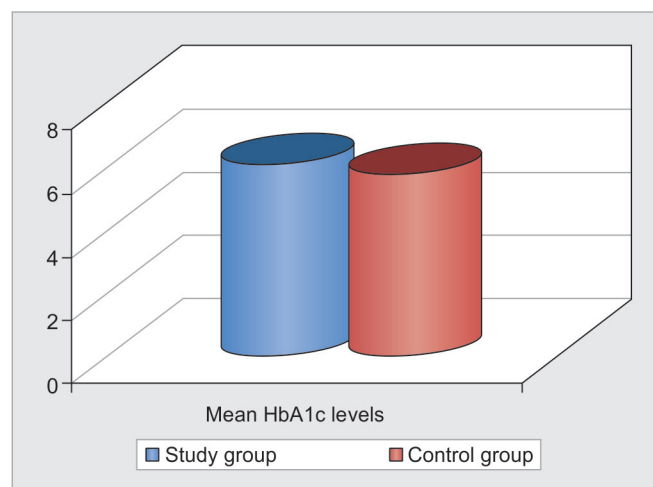
Clinical examination and radiographic evaluation were performed for the selection of the cases for the study group. For the diagnosis of periodontitis in patients of the study group, criteria described previously in literature⁵ were used, which are as follows:

- Patients with five or more teeth with probing depth equal to or more than 5 mm
- Patients with clinical attachment loss of more than 1 mm or bone loss as evident on radiograph
- Patients with bleeding on probing

The patients fulfilling all these criteria were included under the category of the study group. Complete medical history of all the subjects was taken. Queletex formula was used for the measurement of the body mass index (BMI) of the subjects.⁵ The patients were sent to the laboratory after the clinical examination, for the testing of the HbA. Two milliliters of blood was drawn from the patients for the testing of the HbA1c levels. All the results were analyzed by Statistical Package for the Social Sciences software 16.0. Student's t-test, Kruskal–Wallis test, and Chi-square test were used for the assessment of the level of significance; $p > 0.05$ was taken as statistically significant.

RESULTS

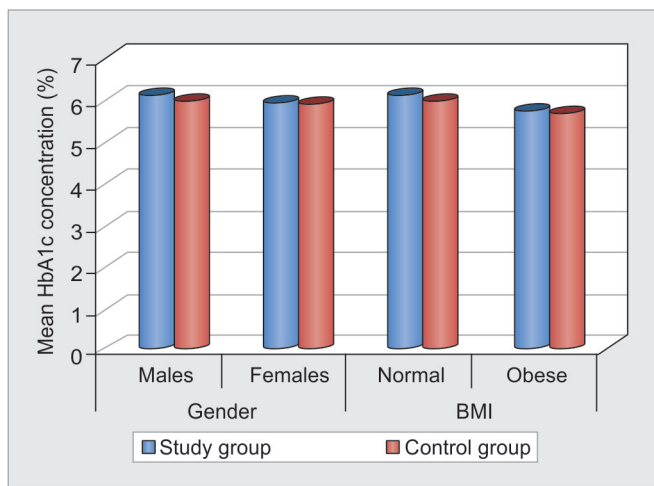
Mean HbA concentrations in the study group and in the control group were 6.120 and 5.824% respectively, as shown in Graph 1. Nonsignificant results were obtained while comparing the mean HbA1c concentrations among the study group and the control group ($p > 0.05$) (Table 1). Among males and females, the mean HbA1c levels (%) in the study group were 6.113 and 5.921 respectively. Nonsignificant results were obtained while comparing the mean HbA1c levels among males and females. Among obese patients, the mean levels of HbA1c (%) were 5.712 and 5.675 respectively. While comparing the mean HbA1c levels between the study group and the control group



Graph 1: Mean glycosylated hemoglobin concentrations (%) among the study group and control group

Table 1: The p-value for the comparison of mean HbA1c levels (%) in patients divided on the basis of gender and BMI

Mean HbA1c levels (%)		Group		p-value
		Study group	Control group	
All patients		6.120	5.824	0.120
Gender	Males	6.113	5.966	0.512
	Females	5.921	5.884	0.221
Body mass index	Normal	6.125	5.982	0.541
	Obese	5.712	5.675	0.842



Graph 2: Mean HbA1c levels (%) in patients divided on the basis of gender and BMI

divided on the basis of BMI, nonsignificant results were obtained (Graph 2).

DISCUSSION

Clarke and Hirsch⁶ proposed the multifactorial model for explaining the etiology of periodontitis. The proposed model incorporated the role of environmental factors, systemic factors, and bacteria for explaining the difference in the susceptibility of individuals for the development of periodontitis. Smoking, diabetes, psychological stress, neutrophil dysfunction, poor oral hygiene status, nutritional deficiency, chronic alcoholism, etc., form the common risk factors for the development of periodontitis. Literature quotes strong evidences which show that pathogenic microorganisms stimulate fibroblasts and other cells present in the periodontal tissue to excrete various inflammatory mediators.^{7,8}

Mean plasma glucose levels are identified by the assessment of HbA1c form of hemoglobin over the past 2 to 3 months. Due to ease of assessment of HbA1c at any time of the day and at most of the pathologic laboratories, it offers a great deal of advantages over the conventional oral glucose tolerance test for the measurement of blood glucose levels.⁹ Estimation of HbA1c levels in periodontitis patients is a topic of ongoing research in many institutions and research centers.¹⁰ Hence, we planned the present study to evaluate the levels of HbA1c in nondiabetic patients with periodontitis.

In the present study, we observed a nonsignificant difference in the levels of HbA1c between the study group and the control group (Graph 1 and Table 1). Although non-significant ($p > 0.05$), the levels of HbA1c in the study group were found to be slightly higher than that of the control group. Our results were in correlation with the results obtained by Saxena and Deepika⁵ who also reported similar findings. Rajan et al¹¹ evaluated the levels

of HbA in patients with chronic periodontitis, which were found to be negative for diabetes. In their case-control study, they assessed the levels of HbA1c using chairside kit and laboratory method in nondiabetic 70 individuals in which diagnosis of chronic periodontitis was confirmed by clinical examination level. They observed that among chronic periodontitis patients, in comparison with the healthy controls, significantly higher value of HbA1c was seen. From the results, they concluded that patients with chronic periodontitis are associated with an elevation in the blood glucose levels of the nondiabetic individuals. These individuals might be at a higher risk for the development of type II diabetes. Saxena and Deepika⁵ assessed the levels of HbA in periodontitis patients who were found to be negative for diabetes. They evaluated a total of 36 patients and divided them into two study groups with 18 patients in each group. The first group included the test group, while the other group included the control group. Test group included those nondiabetic individuals in whom diagnosis of periodontitis was confirmed by clinical examination of the attachment levels. They observed approximately similar levels of HbA1c in both the study groups. However, nonsignificant increase in the values was seen in the test group subjects. Furthermore, they did not observe any difference in the levels of HbA1c between the subjects divided on the basis of gender and mean BMI. From the results, they concluded that Indians constitute a population associated with significantly increased risk for the development of periodontitis and diabetes. Among nondiabetic individuals, a possible link might exist between periodontitis and glycemic control.

We also observed a positive association between the levels of HbA1c and number of sites associated with loss of attachment of more than 3 mm. Our result was in contrast to the results obtained by Wolff et al.⁴ Difference in the severity of the periodontitis cases included in the present study and the study of Wolff et al⁴ might be responsible for the occurrence of such variation. Morita et al¹² evaluated the relationship between the periodontal status of an individual and the condition of diabetes. In the study, approximately 5,600 subjects were evaluated without periodontal pockets of more than or equal to 4 mm at the initial baseline time. For the period of 5 years, the relative risk for the occurrence of periodontal pocket of equal to more than 4 mm was assessed in the individuals in which HbA1c levels were more than 6.5% in comparison to the baseline levels. They observed 1.17 times higher risk for the development of periodontal pocket of greater depth among individuals in whom HbA1c levels were more than 6.5% in comparison to the baseline levels. They concluded that a possible association does exist between the levels of HbA1c and the risk of development of periodontal pathologies. Wolff et al⁴

evaluated the levels of HbA1c in nondiabetic individuals who were diagnosed clinically with periodontitis. They did not observe any significant alteration of the unadjusted HbA1c values between the control group and periodontal group. From the results, they concluded that slight elevation of HbA is seen in periodontitis patients. Rao Deepika and Saxena¹³ analyzed the hypothesis whether HbA1c is elevated in periodontitis nondiabetic patients. They assessed a total of 60 patients and divided them into two study groups. One group consisted of severe periodontitis patients without diabetes, while the other group included controls. They observed an increase in the levels of Hb1Ac in periodontitis patients. From the results, they concluded that no pinpoint link exists between the severe periodontitis and glycemic control in patients without diabetes.

CONCLUSION

From the above results, the authors concluded that in nondiabetic subjects, no significant correlation could be observed between the periodontitis and HbA1c levels. However, future studies are recommended with higher study group and larger parameters for better exploration of this area of dentistry.

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